
Inequality and Sustainability

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This thesis is my original work, except where indicated.

Signed

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Table of Contents

<i>List of Figures and Tables</i>	<i>xvi</i>
<i>Abbreviations and acronyms</i>	<i>xviii</i>
<i>Acknowledgements</i>	<i>xxi</i>
<i>Abstract</i>	<i>1</i>
<i>Synopsis</i>	<i>3</i>
Section one	11
Chapter one: Inequality, sustainability and civilisation	13
Abstract	13
<i>Introduction: Inequality and sustainability</i>	14
Inequality	15
The sustainability of civilisation and anthropocentrism	16
<i>The scope of this thesis: a disclaimer</i>	17
<i>Civilisation failure</i>	18
<i>Paths to civilisation failure</i>	20
The Holocene, the Anthropocene, Gaia and Prometheus	22
Eco-totalitarianism and the global commons	23
Co-operation and the global commons	25
Sustainability	27
Human society and the local environment	29
Ancient civilisation failure and the environment	30
Biodiversity, localised extinctions and the commons	33
<i>Human health and global environmental change: growing awareness</i>	34
The 1960s and 1970s.....	34
The late 1970s and early 1980s.....	36
The resurgence of interest in global change and human health in the late 1980s.....	37
The World Scientists’ Warning to Humanity.....	39

<i>Have epidemiologists been slow to consider global change and human health?</i>	40
Has the research agenda for epidemiology – along with other scientific disciplines - been funnelled away from certain politically sensitive questions? ..	41
The response to the United Nations Conference on Environment and Development in the English-language health literature.....	43
Review articles and conferences	44
Non-English health literature, the World Health Organisation, and global change	45
Global environmental change, human health and society: recent literature	46
<i>Climate change</i>	47
The science of climate change	47
Theory	47
Empirical evidence.....	48
Separating the natural and anthropogenic components of global warming	51
The “carbon sink” and climate change	52
The science of the carbon sink	53
The oceanic carbon sink.....	53
The terrestrial carbon sink.....	54
Climate change and human health	58
“Climate wilding”	60
Sea level change.....	62
The El Niño Southern Oscillation, human health and human society	64
<i>Stratospheric Ozone Depletion</i>	65
The science of stratospheric ozone depletion	65
Stratospheric ozone depletion and human health.....	67
Biodiversity and ecosystem health.....	69
Indonesian logging, inequality, and greed	71
<i>Inertia and global environmental change</i>	74
The Gulf Stream.....	75
Inertia, climate change and stratospheric ozone depletion	76
Bjørn Lomborg, the sceptical environmentalist.....	77
<i>Poverty, human health and epidemiology</i>	80

The rise and decline of Primary Health Care	81
Inequality, human health and epidemiology	85
Conclusion	85
Chapter two: Inequality, sustainability and causality	87
Abstract	87
Introduction	88
Plausibility: Inequality and civilisation failure	89
Re-discovering the link between global inequality and global security	89
The aftermath of September 11, 2001	92
Plausibility: Inequality, adverse environmental change and civilisation failure.....	95
Inequality and environmental public goods	96
Globalisation, global environmental change and risk	97
Athanasίου, Chatterjee, Finger and the Brundtland Report	98
The Worldwatch Institute.....	99
Epidemiology, public health, and ecosystem health	101
Inequality and policy.....	102
Science, power and research	104
Inequality, sustainability and causality	106
Methodology	106
Attitudinal transition	108
Ecological economics.....	109
Plausibility: How might inequality self-propagate?.....	110
Relative poverty, absolute poverty, and ecological economics	111
Kuznets' hypothesis	112
Global environmental consequences of self-propagating inequality	113
Summary	114
Chapter three: Demography, carrying capacity and sustainability.....	117
Abstract	117
Introduction.....	118
Malthusianism and global carrying capacity.....	119
Neo- and anti-Malthusianism.....	123
Overpopulation, the ecological footprint, demographic entrapment and causation...	124

The ecological footprint.....	124
Demographic entrapment.....	126
Poverty, causation and demographic entrapment	129
Cornucopianism, neoliberalism, and US family planning policy	131
1960-1980	131
1981-2001	133
Analysing the change in US family planning policy	134
Julian Simon’s recipe - the “demand” solution to overpopulation	135
Malthusianism and the <i>Population and Development Review</i>	137
Biological naïveté?.....	139
Problems with intensive farming	140
Demography, rapid population growth, and ambivalence	142
Are modern demographers biased away from neo-Malthusianism?.....	144
Demographers, King and the “population establishment”	147
Inequality, governance, and demographic transition	147
Demography, “network closure”, funding and bias.....	148
Ester Boserup	150
<i>Neo-Malthusians, cornucopians and contrarians: the wider debate</i>	151
The Cornucopian enchantment	151
Cassandra’s fate - ignoring the warnings of Science	153
Economics and technological optimism	155
Cornucopians, family planning, and foreign aid.....	156
Conclusion	157
Chapter four: Critical global environmental change	159
Abstract.....	159
Introduction.....	160
<i>Proposition one: "Critical" global environmental change</i>	160
“Dangerous” climate change.....	160
“Dangerous” stratospheric ozone depletion and ecosystem service decline.....	161
<i>Environmental brinkmanship, conflict and civilisation failure</i>	162
The causation of conflict: resource scarcity and the quest for economic security.....	163

The causation of conflict: motivation and opportunity	164
<i>Environmental change and future conflict</i>	164
Global environmental change and food security.....	166
Soil	166
Water	167
Climate change, food security and economics	168
Global grain markets, China, water, and India.....	169
Negotiating the next agricultural transition	171
The global grain harvest.....	172
Grain and conflict.....	174
Runaway climate change and conflict.....	175
Ecosystem service associated conflict	176
Water, oil and conflict.....	177
Other pathways to global civilisation failure	180
Proposition two: Environmental and nuclear brinkmanship.....	181
Nuclear brinkmanship	181
Environmental brinkmanship	183
Comparing environmental and nuclear brinkmanship	186
<i>Proposition three: Quantifying the human impact upon the global environment</i>	188
<i>Proposition four: The poor are at disproportionate risk from "dangerous" global environmental change</i>	189
Intergenerational inequality	191
<i>Conclusion</i>	191
Section two	193
Chapter five: The distribution of global income and power	195
Abstract	195
Introduction.....	196
Discovering and defining the “Third World”: post World War II optimism.....	196
Problems with development.....	197
The debt crisis and structural adjustment programmes.....	199

<i>Income and power</i>	201
<i>The distribution of global income: quantitative evidence</i>	204
<i>Empirical measures of global income distribution: The FX versus PPP debate</i>	206
The Penn World Tables.....	208
The “Eurocentricity” of assumptions used to estimate PPP adjusted incomes.....	210
FX versus PPP: The concept of “international purchasing power”	212
<i>Studies of global income distribution, adjusted for national income distribution</i>	216
The significance of an altered Kravis coefficient	221
Demographic factors in explaining changing global income distribution	223
<i>Conclusion</i>	224
Chapter six: Four studies of global income distribution	227
Abstract.....	227
Introduction.....	228
<i>Method</i>	228
Data sources: foreign exchange adjusted global income distribution analysis 1964-1999.....	229
Population and income data	229
Data source: national income distribution	230
The controversy concerning recent trends in national income distribution	231
An analysis of Gallup <i>et al</i> ’s analysis of the Deininger and Squire dataset	232
Cornia’s analysis of national income distribution.....	234
The influence of changing national income distribution upon global income distribution	235
Assumptions for countries with missing data	236
Missing income data	236
Missing national income distribution data.....	240
Three time series estimates of global PPP adjusted income distribution.....	240
PPP adjusted income datasets	240
Method	241
Calculation of the global Gini coefficient.....	242

Data checks	244
Results	246
Exchange adjusted global income distribution	246
Purchasing power parity global income distribution	249
<i>Discussion</i>	256
Conclusion	266
Chapter seven: Index of global environmental change	269
Abstract	269
Introduction	270
<i>Sustainability Indicators</i>	271
<i>The Index of Global Environmental Change</i>	272
The Living Planet Index: 1970-1995	275
The global ecological footprint: 1961-1997.....	276
<i>Method of construction of the IGEC</i>	277
<i>Atmospheric index</i>	277
Introduction	277
Selection of maximum and minimum values.....	278
Methane.....	281
Selection of maximum and minimum values.....	282
Data transformation.....	283
Weighting.....	284
<i>Results</i>	286
<i>Stratospheric ozone index</i>	287
Introduction	287
Data source.....	287
Method	288
<i>Results</i>	290
Global annual ozone thickness.....	290
Calculation of Stratospheric Ozone Depletion indices	295

Estimates for missing data	295
Global mass of ozone	295
Stratospheric ozone column	299
Selection of maximum and minimum values	299
Data transformation	300
Weighting	301
Results	302
<i>Biodiversity and ecosystem index</i>	305
Introduction	305
<i>Trophic level of marine and fresh water harvests</i>	308
Introduction	308
Data	309
Selection of maximum and minimum values	309
Data transformation	310
Weighting	310
Results	310
<i>Humid tropical forests</i>	312
Introduction	312
Rainforest contrarians	314
Data	316
Selection of maximum and minimum values	316
Data transformation	316
Results	317
<i>Amphibian populations</i>	318
Method	318
Data	319
Data transformation	321
Results	321
Biodiversity and ecosystem function index	322
<i>Index of global environmental change</i>	323

<i>Discussion</i>	327
Problems with the ecological footprint as a sustainability indicator.....	327
<i>Problems with the IGEC</i>	328
Scale	328
Selection bias, measurement error and confounders.....	329
<i>Advantages of the IGEC and future trends of the sub-indices</i>	330
Atmospheric sub-index	330
Stratospheric ozone decline sub-index.....	331
Biodiversity and ecosystem health sub-index	332
<i>The paradox of a declining IGEC and rising human well-being</i>	334
Threshold events	334
<i>Conclusion</i>	335
Section three	337
Chapter eight: Carrying capacity, foresight, complexity and inequality	339
Abstract	339
Introduction.....	340
<i>Carrying capacity, complexity and foresight</i>	341
Problems with the classic economic solution to diminishing marginal returns: Ohlin, free trade and industrialisation	345
Ohlin, Wolfensohn and free trade	346
Optimal population - theory	347
Optimal population – prospects	347
<i>Marginal carrying capacity</i>	348
Optimal population and inequality.....	351
Impact, short and long-term carrying capacity.	351
Optimistic extremists	352
Optimal inequality.....	353
The USSR, Eastern Europe, inequality and the environment	354
The tragedy of the commons – a lack of ownership	355

Excessive equality.....	355
<i>Conclusion</i>	357
Chapter nine: Summary, further research, and conclusion	359
Introduction: global civilisation, sustainability and philosophy	360
A new vocabulary to explain unsustainability	361
Economic contributions	362
Environmental and sustainability indicators	362
Carrying capacity, demography and economics	363
Public health and epidemiology.....	363
Inequality and sustainability	364
The tragedy of the commons and inequality as causes for unsustainability	365
Population, affluence, technology and inequality as causes for unsustainability	367
Paths to sustainability.....	367
Foreign aid and development.....	367
A swing back to regulation?.....	368
Commitment, uncertainty and a campaign of hope	369
Traversing the bottleneck.....	371
Ecosystem repair and protection in the South.....	371
Geo-engineering.....	372
Global security and global inequality	374
Contrarians, uncertainty, evolution and the media	375
Future research suggestions	376
Scenarios of civilisation failure.....	376
<i>Conclusion</i>	378
Appendices.....	379
1. Impacts of climate change on cropping potential of rain-fed cereals	379
2. Method used to estimate global per capita grain production 1966-2001	381
3. Global inequality (FX and PPP adjusted)	383
4. A brief examination of comparative advantage and free trade	384

5: Studies of global income distribution adjusted for national income distribution	388
6. Correspondence with Branko Milanovic	390
7. Correspondence with Professor Albert Berry	396
8. Income distribution for 102 countries	400
9. Regional Gini coefficients.....	404
10. National income distribution for 60 countries	405
11. Table used to estimate the FX Gini coefficient (1999).....	409
12. Indicator set using Worldwatch database (Bossel, 1999)	412
13. Potential indicators for an improved Index of Global Environmental Change	413
Glossary of technical terms	419
Afterword.....	423
Bibliography	426
Index	510
Publications and conference presentations (relevant to thesis)	529

List of Figures and Tables

Figures

2.1 Foreign aid, as a percentage of GNP	94
4.1 World grain consumption 1966-2001	173
5.1 Global inequality: exchange adjusted quintile ratios	207
5.2 Five studies of global income distribution (PPP) adjusted for national income distribution	220
6.1 Exchange adjusted global income distribution 1964-1999: estimated data	237
6.2 Lorenz curve: 1999	243
6.3 Method used to estimate Gini coefficient	244
6.4 Global exchange adjusted income distribution: 1964-1999	247
6.5 The comparative incomes of China, India, Indonesia and Bangladesh: 1972-1999	251
6.6 Global distribution of PPP adjusted income (current international dollars) 1964-1992	253
6.7 Global distribution of PPP adjusted income (constant international dollars) 1960-1998	253
6.8 Global distribution of PPP adjusted income (current international dollars) 1975-1998	254
6.9 Three time series charts of near-global Gini coefficients (PPP)	255
6.10 Comparison of the FX and three PPP time series analyses of global income distribution	257
6.11 Kravis coefficients for India and China (1964-1992)	260
6.12 Annual Kravis coefficients US, Australia, Japan 1964-1992	261
7.1 Annual carbon dioxide concentration: 1832-2000	279
7.2 Carbon dioxide index	281
7.3 Average annual atmospheric methane concentration: 1000-1998	283
7.4 The radiative forcing ratio of carbon dioxide to methane: 1960-1999	285
7.5 Weighted atmospheric index: 1960-1999	286

7.6 Average monthly global stratospheric ozone column thickness: 1978-2001	291
7.7 Average stratospheric ozone layer thickness: 1978-2001 extra-tropical Southern Hemisphere (25°-90° S)	293
7.8 Average stratospheric ozone layer thickness: 1979-2000 Northern Hemisphere (25°-90° N)	294
7.9 Comparison of two times series measures of global ozone 1978-1999	295
7.10 Timing and value of annual maximum and minimum global ozone mass: 1978-1999	297
7.11 Stratospheric ozone depletion indices: 1979-2000	303
7.12 Indices of the average annual trophic levels of marine and fresh water harvests: 1950-1997	311
7.13 Moist (humid) tropical rainforest clearance index: 1960-1997	317
7.14 Raw and corrected data used to compute index of quasi-global amphibian population change: 1950-1997	320
7.15 Quasi-global amphibian population index: 1954-1997	322
7.16 Biodiversity and ecosystem index: 1960-1997	323
7.17 Index of global environmental change (1960-1997)	325
8.1 A tradeoff exists between population size and carrying capacity	343

Tables

4.1. Contrasts and similarities between and of nuclear and environmental brinkmanship	187
5.1 PPP data relies extensively upon extrapolation	209
5.2 Factors which influence individual and average incomes and purchasing power in low and high FX economies	213
6.1 Analysis of national inequality (Deininger and Squire dataset)	233
6.2 Income categories used to estimate missing income data	239
6.3 Summary of final FX analysis for 1964-1999 in current US\$	248-49
7.1 List of original (maximum) and minimum levels used to construct index of global environmental change	273

Abbreviations and acronyms

AIDS	Acquired Immuno-Deficiency Syndrome
ANU	Australian National University
bp	before present
BMJ	British Medical Journal ¹
C	carbon
CH ₄	methane
CFC	chlorofluorocarbon
CO ₂	carbon dioxide
CRES	Centre for Resource and Environment Studies
EKC	environmental Kuznets curve
ENSO	El Niño Southern Oscillation
FAO	Food and Agricultural Association
FX	foreign exchange (adjusted)
G7	Group of Seven
GEC	global environmental change
GDP	gross domestic product
GID	global income distribution
GHG	greenhouse gas
GMO	genetically modified organisms
GNP	gross national product
GPI	Genuine Progress Indicator
Gt	gigaton (10 ⁹ tons).
ha	hectare
H-1211	halon-1211
HIV	Human Immunodeficiency Virus
IIASA	International Institute for Applied Systems Analysis
ICP	International Comparison Project

¹ The British Medical Journal changed its name to the acronym several years ago.

IGEC	Index of Global Environmental Change
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
IRRI	International Rice Research Institute
KC	Kravis coefficient
ky	kiloyears
JAMA	Journal of the American Medical Association
LSE	London School of Economics
LSH&TM	London School of Hygiene and Tropical Medicine
m	metre
MAPW	Medical Association for the Prevention of War
MJA	Medical Journal of Australia
mm	millimetre
NASA	National Aeronautics and Space Administration
NBP	net biome production
NCEPH	National Centre for Epidemiology and Population Health
NEP	net ecosystem production
NGO	non-government organisation(s)
NID	national income distribution
NIWA	National Institute for Water and Atmospheric Research
NOAA	National Oceanic and Atmospheric Administration
NPP	net primary production
NRC	National Research Council
OCF	Our Common Future
ODS	ozone depleting substance(s)
OECD	Organisation for Economic Development and Co-operation
OPEC	Organisation of Petroleum Exporting Countries
pa	per annum
pc	per capita
PHC	Primary Health Care
PNG	Papua New Guinea
ppbv	parts per billion by volume

ppmv	parts per million by volume
PPP	purchasing power parity
pptv	parts per trillion by volume
PRC	Peoples Republic of China
PWT	Penn World Tables
RSPAS	Research School of Pacific and Asian Studies
RSBS	Research School of Biological Sciences
RSSS	Research School of Social Sciences
SAPs	structural adjustment programme(s)
SF ₅ CF ₃	trifluoromethyl sulphur pentafluoride
SLAPP	strategic law suit(s) against public participation
SOL	stratospheric ozone layer
SOD	stratospheric ozone depletion
SST	sea surface temperature(s)
UK	United Kingdom
UN	United Nations
UNCED	United Nations Conference for Environment and Development
UNCTAD	United Nations Conference on Trade and Aid
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFPA	United Nations Fund for Population Activities
US	United States
USSR	Union of Soviet Socialist Republics
UVR	ultra violet radiation
WB	World Bank
WCED	World Commission on Environment and Development
WDI	World Development Indicators
WDR	World Development Report
WHO	World Health Organisation
WMD	weapons of mass destruction
WW	World War
WWF	Worldwide Fund for Nature

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Inequality and Sustainability

Abstract

Global civilisation, and therefore population health, is threatened by excessive inequality, weapons of mass destruction, inadequate economic and political theory and adverse global environmental change. The unequal distribution of global foreign exchange adjusted income is both a cause and a reflection of global social characteristics responsible for many aspects of these inter-related crises.

The global distribution of foreign exchange adjusted income for the period 1964-1999 is examined. Using data for more than 99% of the global population, a substantial divergence in its distribution is found. The global Gini co-efficient, adjusted for national income inequality, increased from an already high value of 71% in 1964 to peak at more than 80% in 1995, before falling, very slightly, to 79% in 1999. The global distribution of purchasing parity power income is also examined, for a similar period. Though also found to be extremely unequal, its trend has not been to increased inequality. Implications of the differences between these two trends are discussed.

A weighted time series index of global environmental change (IGEC) for the period 1960-1997 was also calculated. This uses nine categories of global time series environmental data, each scaled so that 100% represents the level of each category in nature prior to anthropogenic change; zero represents decline to a critical point. This index fell from 82% in 1960 to 55% in 1997, and will further decline during this century.

Using evidence from several disciplines, it is argued that the decline in the IGEC correlates with major macro-environmental changes, which, combined with flawed social responses to scarcity and its perception, place at risk the ability of civilisation to function. This could occur because of the interaction of conflict, economically disastrous extreme climatic events, deterioration of other ecosystem services, regional food and water insecurity, and currently unforeseen events. Uncertainty regarding both a safe rate of decline and the tolerable nadir of the IGEC is substantial.

Substantial reduction in the inequality of foreign exchange adjusted income is vital to enhance the development of policies able to reverse the decline in the environmental goods which underpin civilisation, and to promote the co-operation needed to maximise the chance that civilisation will survive.

Synopsis

This thesis is multi-disciplinary, drawing especially from epidemiology, environmental science, pherology,¹ economics and demography. It is divided into three main sections. The first introduces the main ideas, propositions, and non-economic literature upon which the thesis is constructed. The second section presents an improved, comprehensive measure of global economic inequality and an index of global environmental change, and also discusses relevant literature of a more technical nature. The final section has two chapters. The first presents a new theory concerning carrying capacity and inequality, and attempts to explain the main argument of the thesis from a different view. The final chapter summarises the main contributions of the thesis and suggests avenues for further research.

Section one

Chapter one introduces three main elements of the thesis. Two – inequality and sustainability – already have a vast literature. The third, “civilisation failure” is less familiar, but it too is attracting increasing attention, though not generally as this term. The writer’s home academic discipline is in public health and epidemiology, and this chapter contains an extensive review of the health literature concerning global environmental change (GEC). The chapter argues that the most serious potential adverse health effects of GEC is via a pathway of significant global “civilisation failure”.

To substantiate this claim, the chapter reviews the general scientific literature relevant to many aspects of global environmental change. This is also done to introduce the “Index of Global Environmental Change” (IGEC) in section two. The chapter concludes that adverse human health effects resulting from GEC is a legitimate, currently under-explored topic for public health research and that seeking to better understand the causes of GEC is an important and legitimate research question.

Chapter two introduces the main idea explored by this thesis, which is that the contemporary scale of global inequality risks civilisation failure by undermining and

¹ The science of carrying capacity

obstructing efforts to achieve sustainability, while at the same time risking the provocation of a “global guerrilla war” via pathways of large-scale population exclusion and resentment. It is argued that inequality acts to undermine sustainability via the cumulative effect of many individual government policies.

The methodology used in the thesis is discussed. It is argued that the existing epidemiological causal criteria can be adapted to contribute to causal theory for the emerging discipline of “sustainability science”, and that the thesis makes important steps towards this. These include quantitative estimates of the distribution and trend of global economic power and the scale and trend of global environmental change, over recent decades. However, causation in this field will primarily depend on plausibility. Because of the inevitability of both uncertainty and pre-existing (Bayesian) biases, it is admitted that adducing causality beyond all doubt will continue to be elusive. Nevertheless, the evidence of a causal relationship between inequality and sustainability is at least as strong as that for most existing economic and policy assertions.

I argue that inequality – the relationship between groups with different power on a global scale – acts most directly to impair sustainability by delaying the global *attitudinal transition* by limiting awareness, at both elite and public levels, of the risks to civilisation from both inequality *itself*, and also from adverse global environmental change. This leads to policy making which obstructs the other, material elements of the sustainability transition.

Chapter three introduces the conventional, alternative pathway to the global sustainability transition, termed, provocatively, the “Cornucopian enchantment”. This is an exaggerated, simplistic set of arguments, based almost on magical thinking, which essentially proposes that sustainability can be achieved, with little effort, almost automatically, provided certain economic elements – especially free market principles – are embedded into global society. The most articulate spokesperson associated with this view is the late Julian Simon. The literature that gives rise to Cornucopianism is generally founded on reality, but an exaggerated form has great potency, and properly deserves the term “enchantment”. An alternative – and less charitable explanation for the widespread faith in Cornucopian principles is that it avoids any effort to redistribute wealth and power, and thus is compatible with increasing inequality and the self-interest of powerful populations. Probably both explanations are partially true.

This chapter also reviews a fragment of recent demographic literature regarding the debate between neo- and anti-Malthusianism, concentrating mainly on a single journal, the *Population and Development Review*. It proposes, controversially, that the relevant papers in this have accepted the anti-Malthusian arguments too uncritically. Whether in response to subtle funding pressures, from a withdrawal of engagement with the issue, or for both reasons, it is suggested that demographers in recent decades have not acted with sufficiently clarity and purpose to effectively challenge the unconscious adoption of the Cornucopian enchantment by elite policy makers. A consequence of this has been the worldwide trend to reduced foreign aid. By default, this has delayed the demographic transition, thus making the attainment of global sustainability more problematic.

Of course, demographers cannot be held to have any special responsibility for the decline in foreign aid, nor any unique responsibility to contribute to the debate concerning global human carrying capacity. Nevertheless, it is suggested that if demographers had not distanced themselves as much, as a profession, from neo-Malthusians, lobby groups such as the Union of Concerned Scientists, and the general debate concerning sustainability, then the politically conservative advocates of the free market are likely to have had less influence upon government, especially with regard to reduced foreign aid, structural adjustment programmes, and other free market policies imposed on the Third World.

The final chapter in this section discusses two more key concepts, that of “critical environmental change” and “environmental brinkmanship”. These provide a conceptual framework to explain how global environmental change may cause global civilisation failure, and thus cripple population health. Environmental brinkmanship is likened to nuclear brinkmanship, acting over a longer timescale, which undermines the environmental public goods which civilisation relies on, including for food security. It is argued that powerful populations are prepared to countenance environmental brinkmanship not only because of their faith in the free market, but also because of a perceived insurance policy provided by their power, income and affluence.

Again, therefore, global inequality provides a unifying mechanism to explain how environmental brinkmanship, and hence the erosion of sustainability, occurs.

Section two

Chapter five reviews the existing literature related to both subjective and objective measures of global inequality. It focuses on the health impacts of economic conditions in the Third World since World War II (WWII). It argues that the general rate of improvement in health in the first post-war decades, when there was less global emphasis on the free market policies, slowed when the global free-market became more powerful, especially in sub-Saharan Africa. This chapter also reviews the quantitative literature of global income inequality, in terms of foreign exchange (FX) and adjusted for purchasing power parity (PPP). This is relevant for chapter six, in which four time series studies of global income inequality, undertaken for this thesis, are presented. It is argued that FX adjusted income is the appropriate indicator of global political influence (compared to PPP adjusted measures), mainly because governments accrue foreign debt in FX terms. National inequality, especially in the Third World, evidenced by a widespread lack of democracy and government accountability, also helps to exacerbate indebtedness. This is because such governments are frequently prepared to sanction further debt to maintain living standards for their elite populations and their own power, including by the purchase of arms. This is the case even though a consequence is further economic and health disadvantage experienced by their general populations.

Chapter six presents four time series studies of global income inequality undertaken for this thesis. One study, using FX terms, finds a clear divergence in global income distribution, while the three PPP studies show no evidence of such a divergence. However, the data are sufficient to show that the relationship between the FX and PPP measures has changed over time. This is examined in detail for China and India. It is found that the Kravis coefficient² of the average income for these countries increased substantially during the 1970s and 1980s. It is argued that this represents a significant, previously undescribed, form of interest, which in this period acted to disadvantage these countries.

Chapter seven presents a fifth quantitative time series analysis, called the Index of Global Environmental Change. This draws on global environmental data, comprised of six main indicators, two atmospheric, one stratospheric, and three concerned with marine and terrestrial ecosystems. Technical literature relevant to each indicator is also reviewed.

² The ratio of PPP to FX adjusted incomes.

Section three

Chapter eight proposes that existing theories of human carrying capacity are flawed by insufficient consideration of inequality. Inequality, within limits, can act to increase or to decrease total human carrying capacity. Over comparatively short periods, inequality can effectively increase the living standards of powerful populations. It can do this – provided the total population is limited – without approaching *global* carrying capacity limits, provided the ecological utilisation of the marginal (additional) population is low. Indeed, this describes the recent global situation.

However, over a longer time period, the living standards of the disadvantaged population may deteriorate relatively, and even absolutely – at least if insufficient dissemination of technological and material progress occurs. This threatens civilisation failure in several ways. Resentment is likely to increase within the comparatively disadvantaged population, leading to civil strife and insurgency. This is likely to be concentrated within poor populations, but is unlikely to be confined there. Consequences of a global guerrilla war are likely to include reduced economic growth, civilisation failure, and eventually, civilisation collapse. We may already be on the brink of such a world.

Additionally, even though the ecological impact of the comparatively poor fraction of the population is low on a per-capita basis its large size still adds significantly to the erosion of environmental global public goods, thus independently increasing the risk of critical global change and, eventually, civilisation failure. To reduce the risk of a global guerrilla war, living standards of poor populations need to be increased. Paradoxically, this will increase the rate of erosion of environmental global public goods.

The chapter also introduces the concept of marginal carrying capacity. It argues that any area and its associated population is characterised by a certain carrying capacity, a function particularly of resources, technology, ingenuity, organisation, debt and offshore income, including interest. Average living standards correlate with the per capita carrying capacity. At low populations, or when technology or other carrying capacity “co-factors” are increasing, population increments are likely to be comparatively welcomed. But as the rate of increase in carrying capacity slows, additional population are unlikely to be as welcomed, unless the living standard of the incoming population is substantially below that of the average population. Beyond another point, additional population may start to be resented, even if they are comparatively poor. This is not only because, at this point, they are unlikely to increase the

average living standard of the general population, but because they may even decrease it, or be perceived as so doing, because, for example of additional policing expenses and other transaction costs.

At a global scale, powerful populations reserve extensive resources, both to enable the high living standards enjoyed by their population, and also as a stock for the future. By definition, these resources are denied to less powerful populations, thus reducing their potential living standard. Estimates of the maximum theoretical global human population need to be reduced in view of this.

Chapter nine reviews the main contributions made by this thesis, and suggests several avenues for future research. The most important contribution is the argument that the current scale of global inequality undermines attempts to achieve sustainability. It reviews the terms of a new vocabulary to explain this. These include “environmental brinkmanship”, “civilisation failure”, “critical global environmental change” and the “Cornucopian enchantment”. Essentially, powerful elements within civilisation, enchanted by both the cornucopian vision and their own enjoyment – made possible by the scale of inequality – embrace policies that lead to environmental brinkmanship. In turn, civilisation failure is threatened, in the short run by a global guerrilla war, and over a longer time, by critical global environmental change.

Secondly, the thesis comprehensively demonstrates, quantitatively, the extent of global income inequality over recent decades. It improves substantially on all previous measures of global exchange adjusted income inequality by its annual resolution, and by more completely accounting for changes in national income distribution. Thirdly, it suggests for the first time that changes in the Kravis coefficient act as either a hidden interest or subsidy for countries repaying loans in exchange adjusted currency. Fourthly, the thesis presents an authoritative, comprehensive and quantitative measure of global environmental change that surpasses previous measures because of its comprehensiveness and reduced selection bias.

A fifth contribution is the suggestion that carrying capacity theories need to explicitly consider the appropriation of carrying capacity by powerful populations. Finally, it suggests that several scientific fields, especially demography, have been insufficiently critical in the face of the Cornucopian enchantment.

This thesis should stimulate further work in several disciplines, including the emerging discipline of sustainability science. It serves as a conceptual basis for attempts to quantify civilisation failure, by creating different future scenarios. For example, these could assume

different rates of population growth, inequality, technological change, adverse global environmental change, and access by disadvantaged, resentful populations to weapons of mass destruction.

Secondly, the thesis should serve as an incentive to both extend and improve measures of global environmental change and also of inequality. It should stimulate a more critical examination of the concept of purchasing power parity income, further development of measures of genuine income, and of the relationship between exchange adjusted and purchasing power parity income.

The thesis concludes that even in the best case, environmental brinkmanship will continue for the rest of this century. Civilisation will need a deal of luck to survive. To minimise what is an unconscionable risk, civilisation needs to urgently adopt policies to accelerate the sustainability transition. Reducing inequality will accelerate the demographic transition, while technological and organisational transition will slow environmental brinkmanship. Reliance on poor populations as a form of safety net to protect wealthier populations is unacceptable for both moral and strategic reasons. Recognition of the pervasiveness and risk of this thinking will help to drive the attitudinal transition needed among wealthy populations to generate the political and technological changes required.

It is concluded that to increase the chance of sustainability policy makers will need to devise ways to redistribute wealth to poorer populations, mainstream economists will have to adopt the principles of ecological economics, and scientists as a whole will need to better inform the general public of the urgency and changes needed to facilitate the sustainability transition.

At the end of the bound volume, following the bibliography and index, is a collection of papers³ relevant to the thesis and published or submitted during it. Many of these are referred to in the text.

³ Written or co-written by the author.